

viously advised in only 1, and in several cases the patient was advised against operation by prominent physicians. Can it be that the internists who had charge of these patients had attempted to follow the after-results of their treatment and realized the absolute failure of medical measures to give permanent relief? Is it not time that the results of excision of the thyroid in the hands of experienced men should be recognized? Is there any other operation of equal gravity which has been performed by any man with but one death in 661 cases, as in Kocher's latest report?

In closing, I would again emphasize the importance of early diagnosis, when in some cases there is still hope of relief by palliative measures. I would refer once more to the grave prognosis in all well-developed cases of exophthalmic goitre; to the difficulties of distinguishing benign from malignant tumors of the thyroid in the early stages of development; to the frequency of malignancy and the absolutely hopeless prognosis in malignant cases unless the growth is excised early, before a positive diagnosis can be made. I would again mention that reports of cases treated by medical measures alone show a death rate higher than those operated upon, and this in spite of the fact that usually only the most unfavorable cases have been submitted to excision; that operative measures have cured or relieved a proportionately larger number than any (I might almost say all) other treatments. In view of these facts it seems clear to me that all patients resisting the approved therapeutic measures should be urged to consult a competent surgeon.

TENDON TRANSPLANTATION IN THE TREATMENT OF CONGENITAL AND ACQUIRED TALIPES.

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THE general surgeon has always been more or less dissatisfied with the treatment of deformities by means of apparatus, and, has, whenever practicable, preferred operative treatment, with its rapid results, to the slow and at times unappreciable progress which is attained by the use of braces. It is, however, chiefly owing to the teaching of Vulpius in Germany, and of Tubby and Jones in England, themselves orthopedists, that tendon transplantation has become a recognized form of treatment for paralysis. In this country it does not appear to have been very widely employed heretofore, and patients with infantile palsy have drifted about from one clinic to another, or, in rare instances, have grown from children to adults under the care of one individual. And though it cannot be denied that the treatment by apparatus is a great help, not only in increasing

the power of locomotion, but also in aiding the paralyzed muscles to regain their strength, yet when all has been said in its favor, and when the patients have faithfully done their part in the treatment, the fact remains that after all the limb is still paralyzed, and is in many cases nearly useless without the brace, or would soon become so through contractions of healthy muscles, were the support of the apparatus to be discarded.

In regard to congenital club foot, the general surgeon has been in the habit of resorting to open operation to correct the deformity more frequently than the orthopedist, who has usually preferred repeated stretchings (*redressement*, *Mobilisirung*), and retention with a brace. Astragalectomy, cuneiform tarsectomy, as well as open tenotomies and fasciotomies, although satisfactory for the time being, are very apt to prove merely temporary successes, especially in dispensary patients, who when not under constant observation frequently return after eight months or a year with a deformity very nearly as marked as before the first operation. In these cases the cause of the recrudescence of the deformity is not regeneration of the excised bone; and to attempt a cure by further excisions is evidently futile. The deforming factor now, as in the first instance, is the action of one set of muscles to the annihilation of another set. By this constant distortion of the foot the child's weight is not brought squarely on the sole, and the bone is forced to adapt itself to the changed conditions and the altered pressure, just as the infant's more pliable bones were during intra-uterine and early postnatal life. Whether the so-called congenital club foot, seen in its typical form as equinovarus, may with justice be considered a sequel of foetal anterior poliomyelitis, does not concern us here. The feet which relapse after full correction and temporary retention by plaster and braces do so because the distorting muscles are stronger than those opposed to them, precisely as in the case of infantile palsy; and there is, therefore, no good reason *a priori* why tendon transplantation should not be adopted as a cure in these as well as in cases of infantile paralysis.

It remains, of course, to select the cases. Needless to say, the majority of patients with congenital or acquired club-foot will not require operation. By correction of the deformity and retention in proper position by apparatus for six months or a year, the weaker groups of muscles will recover their power more or less completely, and though the feet may never be as perfectly shaped or be used as gracefully as normal feet, yet they will be inconspicuous when covered by shoes, and will be eminently useful.

Considering the patients with infantile palsy first, it may be said that as a general rule from one to two years should be allowed to elapse between the onset of the paralysis and the resort to tendon transplantation. Some surgeons think six months a sufficiently long time to wait for return of power. From my own observation, however, I am quite sure that this is not giving the paralyzed muscles

a fair chance. Not only should massage and electricity be resorted to, in the effort to maintain nutrition, but the weak muscles should be relieved of all strain; for they will thus be enabled to acquire strength very much more rapidly. This fact has been well recognized since Owen Thomas drew such prominent attention to it. It is indeed surprising to see muscles, which at first appear hopelessly paralyzed, gradually regain strength when all excessive labor is removed from them by the use of a proper brace. I have in mind now a child who came to the Orthopedic Hospital in October last, with apparently complete paralysis of all the muscles on the anterior aspect of the foot. The paralysis, due to anterior poliomyelitis, was of some six years duration; and she had received no treatment for it. It was especially noted that there was paralysis of the extensor longus digitorum, among other muscles. After wearing a brace for four months, to support the foot, thus overcoming the ankle-drop and relieving the long extensor of all strain, this muscle gradually regained its strength, and she could by February quite forcefully extend the toes. It is not, of course, likely that the remaining paralyzed muscles will recover also, and she will in all probability still be forced to have some tendons transplanted to assist this muscle in its work; but certainly it would have been bad surgery to plunge in at once and operate before making trial of other methods. Nor is this an isolated case. Such patients are encountered by observant surgeons everywhere.

But when a patient has been under competent surgical treatment for a year or so following the paralysis, and after massage, electricity, and relief of the paralyzed muscles from strain have all been tried, it is almost certain that no further improvement will occur; and at this stage tendon transplantation offers the best prognosis.

Nerve transplantation may be considered as an alternative. Having had no personal experience with the operation, I cannot speak with as much confidence of it as I can of tendon transplantation; but there are several theoretical objections which may be urged against it. In the first place its field is much more limited, for it is useless to transplant nerves except when the palsy is exclusively confined to the distribution of one nerve, and when all the muscles supplied by that nerve are affected. Thus, if the tibialis anticus is paralyzed, but not the extensor proprius hallucis nor the extensor longus digitorum, transfer of the anterior tibial nerve into the musculocutaneous might possibly restore its power to the tibialis anticus, but the risk of failure would remain, and the very much greater risk would exist of permanently paralyzing the other muscles supplied by the anterior tibial nerve. A further objection to nerve transplantation is its uncertainty, and the long period over which this uncertainty as to results extends. It is no unusual thing for the nerve into which the transplantation is made to be itself paralyzed by the operation, and I have known this paralysis of the healthy

nerve to persist (in the upper extremity) for three months or more; and at the end of that time it will still be uncertain whether the paralyzed nerve will ever transmit stimuli received through its new anastomosis. The question of the extent to which the degeneration of the paralyzed muscles has gone, must also be considered in the attempt to restore their contractility by nerve impulses. In tendon transplantation, on the other hand, the field is limited only by the number of tendons available; the results are definite and prompt; and no danger exists of rendering the paralysis worse than before the operation was done.

In congenital club-foot it seems safe to allow a longer period to elapse before resorting to tendon transplantation. Here, too, it is probable that correction of the deformity and maintenance in the corrected position, will, by facilitating the normal action of all the muscles, soon render the weaker groups powerful enough to hold the foot straight. If failure attends these efforts, and especially if maintenance of the normal position proves impossible, then resort to tendon transplantation will hasten a cure, and enable braces to be promptly discarded.

As preparation for the operation it is above all things essential that the foot be easily retained temporarily in the desired position, preferably in over-correction. This is to be attained by the usual methods of manipulation, stretching, and by tenotomies when necessary. When the foot has been made almost flail-like, so that its over-corrected position can easily be maintained by the pressure of one finger, then it is ready for the transplantation. It is best not to transplant at the same sitting at which a forcible stretching, under ether, is done. As a rule this procedure causes a certain amount of contusion and œdema, and would predispose an open wound to infection. Ten days or two weeks after the foot has become perfectly flaccid by stretching, the cast used for retention may be removed, and open operation performed. If necessary, of course, several stretchings are to be done before the final operation of tendon transplantation.

The technique of the operation is sufficiently simple, but requires an accurate anatomical knowledge, which is scarcely less important than the knowledge of the functions of the various muscles, on which the principle of the operation is based. The use of an Esmarch bandage considerably accelerates matters, since veins may be seen and avoided, and all the dissections are rapid and bloodless. The band should be placed *above* the knee, so as in no way to constrict the muscles it is proposed to transplant. It is needless to say that the surgeon must have decided positively on the method of operation before ether is given.

Periosteal implantation is generally acknowledged to give better results than transplantation into another tendon; and a more sure result will also be obtained by transferring a healthy tendon to the

place of a weak one, than by suturing the distal end of the paralyzed tendon into a normal tendon. The typical operation is that for varus, where the peronei are paralyzed or weak, and where the tibialis anticus is the deforming factor. In such cases, therefore, separation of the tibialis anticus from its insertion, and its subcutaneous transference to the point of insertion of the peroneus brevis, with its suture firmly into the periosteum at that point, will give a much more satisfactory result than will division of the peroneus brevis some distance from its insertion, and the transference of its distal end into the tibialis anticus. More satisfactory results also will follow transplantation of an extensor tendon for extensor paralysis, or of a flexor tendon for flexor paralysis, than will attend the use of a flexor muscle to overcome extensor palsy, or vice versa. Yet when all of one group of muscles are paralyzed, it may then become necessary to transplant a muscle whose function is directly the reverse of that we wish to develop. Thus in Case II, in which there was paralysis not only of the anterior tibial group but of the peronei and of the tibialis posticus as well, I was forced to take the flexor longus hallucis, which was strong and a deforming factor, from the sole of the foot, and bring it forward through the interosseous membrane to the dorsum of the foot where it was sutured to the extensor longus digitorum.

The incision to separate from its insertion the tendon which it is desired to transplant need not as a rule be long. It is made in the line of the tendon; the sheath is opened, the tendon is grasped by clamp forceps to keep it from retracting when cut, and it is then cut at the desired point. The tibialis anticus must be shaved from the scaphoid and internal cuneiform bones, as it is none too long to reach to the insertion of the peroneus brevis. Longer tendons may be cut higher, and their distal ends sutured to neighboring sound tendons, as in the case of the extensor longus hallucis, whose distal end may be sutured to the extensor longus digitorum. The next step usually is to bare the tendon above the annular ligament, and draw it out here. Then an incision is made over the desired point of insertion, and by burrowing a subcutaneous channel up to above the annular ligament the tendon is caught in forceps, or attached by sutures to a probe, and drawn down to the point where it is to be permanently anchored. The incision over this latter point should not be made precisely in the line in which the transplanted tendon will pull, since the tendon might delay union of the skin by tension. It is better to make an incision oblique, or a little to one side, or even to turn up a flap of skin if more room is required.

The suture material is a matter of some discussion. Some surgeons think silk is preferable, because it is permanent, and hence there is thought to be less danger of the tendon pulling loose. Having had precisely this experience, however, with the patient in Case IV, in whom silk was the suture material employed, I feel rather

partial to chromicized catgut, which has given perfectly satisfactory and thus far at least perfectly permanent results. The transplanted tendon should be sutured with the utmost possible tension, and with indubitable security. A fairly heavy needle and thread are required, and mattress sutures are the best. The knot should never be on the tendon, but is preferably placed to one side or other. In some cases, as in suturing the tibialis anticus to the tuberosity of the fifth metatarsal bone it is possible to place the knots in the sole of the foot, suturing through the bone—which is cartilaginous in children. The knots should not be in any position in which they may subsequently cause annoyance. This applies especially to silk, which is not absorbed. In the sole of the foot they are protected by so thick a pad of fat that no trouble need be expected.

The skin wounds are closed with chromic gut, and the foot is dressed before the Esmarch band is removed. The limb is kept elevated both while the plaster is being applied, and for forty-eight hours subsequently in bed.

The cast may be changed at the end of three or four weeks, if it seems desirable to do so; but free motion of the foot should not be allowed for six to eight weeks. It is exceptional then for a brace to be required; but in some cases of extensive paralysis it may be advisable to continue the support to the foot for some months. Usually an ordinary shoe may be worn, or one with the sole raised on the transplanted side, the outer side raised for varus, the inner raised for valgus deformities.

For permission to operate on and to report the following cases I am indebted to Drs. G. G. Davis, and R. H. Harte, in whose services at the Orthopedic Hospital they occurred.

CASE I.—Israel S., aged seven years, entered the service of Dr. Davis at the Orthopedic Hospital, January 23, 1906. He had been born with marked equinovarus of the right foot. Until the age of four years he had been under treatment at another hospital in this city, where tenotomies of the tibialis posticus, tendo Achillis, and plantar fascia were done. The fact that the posterior rather than the anterior tibial tendon was divided shows the extreme grade of deformity present. Since the age of four years he has worn a brace, but has not been under surgical observation, the brace being repaired by the maker from time to time. When first seen at the Orthopedic Hospital, there was still present marked varus, the equinus having nearly disappeared. The foot was forcibly stretched the patient being anesthetized, February 2, April 27, and May 17, 1906. In spite of complete over-correction of the deformity, the peroneal muscles remained powerless to hold the foot in the corrected position, and tendon transplantation was determined upon. On June 15, 1906, the tibialis anticus was separated from its insertion into the scaphoid and internal cuneiform bones, and by means of a fine-pointed bistoury the sheath of the tendon was slit up through

the annular ligament without making a separate wound above this latter structure to draw the tendon out. An incision was then made over the tuberosity of the fifth metatarsal bone, and the tendon was transplanted subcutaneously across the dorsum of the foot from one wound to the other. By placing the foot in the position of valgus deformity the tendon of the tibialis anticus could now be made to reach the desired point, with great tension. By means of a strong curved needle, entered on the plantar aspect of the metatarsal bone, a mattress suture was inserted through the transplanted tendon, which was thus firmly pulled down and united to the periosteum, the knot being placed on the sole of the foot, and the suture passing through the bone. A second suture of chromic gut united the transplanted tendon to the tendon of the peroneus brevis, just at its insertion, and a third suture was passed through the fascia



FIG. 1.—Case I. Congenital varus of the right foot, after operation.

and periosteum on the dorsum of the foot. The skin wounds were closed with chromic gut, and a plaster cast was applied. The time of the operation was thirty-five minutes. The cast was removed July 20, five weeks after the operation. The transplanted tendon could be easily seen and felt beneath the skin in its new situation, and by its contraction effectually prevented the previous varus deformity. Four days later the patient was allowed to walk. To prevent any undue strain on the foot, he was directed to have the outer side of the sole of his shoe extended and raised a quarter or three-eighths of an inch. An instep strap was also applied. Fig. 1, from a photograph made March 5, 1907, shows the shape of the foot at that date. As he still has a tendency to wear down the outer side of his heel, he still uses a shoe with the sole raised on the outer side.

CASE II.—Tony M., aged four years, entered the service of Dr. Harte at the Orthopedic Hospital, April 26, 1906. At the age of fifteen months, some time after learning to walk, he had an attack of poliomyelitis which left his left lower extremity nearly powerless. About one year after this attack he was brought to the Orthopedic Hospital and there fitted with a brace, which he wore until admitted to Dr. Harte's service in 1906. Without the brace he could walk only with great difficulty. His foot was in the position of equinovarus, and without the brace he walked on the outer surface of his foot and on the external malleolus. There was complete loss of power in the tibialis anticus, the extensor longus digitorum, and extensor longus hallucis, in the peronei muscles, and only very slight power in the tibialis posticus, the calf muscles, and the flexor longus digitorum. The flexor longus hallucis alone appeared to be normal in its contractility, and was also a deforming factor, aiding in producing the equinus and the varus, and drawing the great toe into a position of marked flexion. The tendo Achillis was contracted, and it was impossible to bring the foot up to right angles with the leg. On May 3, 1906, under ether anesthesia, the tendo Achillis was cut, and the foot was forcibly stretched, until it could be made to assume the calcaneo-valgus position. The great toe was even more distorted by the contraction of the flexor longus hallucis, but it was not thought advisable to divide this at that time. The patient was kept in bed for twelve weeks, while the recuperative powers of the various muscles were being tried under the influence of mechanical support, massage, and electricity. At the end of this time, as very little if any improvement was noted, it was determined to try a tendon transplantation, as arthrodesis is rarely satisfactory at so early an age. The only strong tendon being the flexor longus hallucis, and this also being a deforming factor, it was decided, after consultation with Drs. Harte and Davis, to attempt its transplantation to the dorsum of the foot, through the interosseous membrane. It was thought that since the muscle lay close against the interosseous membrane, it would be more effectual to bring it directly through than to bring it around the internal surface of the tibia. Accordingly, on July 26, 1906, under ether anesthesia, and with an Esmarch bandage applied, an incision was made along the inner border of the sole, about two inches in length. The abductor hallucis was separated from the plantar fascia and the flexor brevis digitorum, exposing the internal plantar artery and nerves. These were drawn to the inner (tibial) border of the sole, along with the abductor hallucis, and the flexor longus digitorum was recognized. Between this and the metatarsal bones, the tendon of the flexor longus hallucis was detected, and its identity was proved by its function. It was then divided, and its distal end sutured to the tendon of the flexor longus digitorum, while its proximal end, after freeing the tendinous slip which passes from it to the tendon of the

flexor longus digitorum above the point of section, was then drawn out of the wound. A second incision was then made along the inner side of the tendo Achillis, back of the inner malleolus, and the tendon of the flexor longus hallucis isolated just to the posterior side of the posterior tibial nerve. The tendon was then drawn out of this wound. By means of a periosteal separator the interosseous membrane was then perforated, keeping close to the fibula. A third incision was then made on the point of the periosteal separator, between the tendons of the tibialis anticus and extensor longus hallucis. The tendon of the flexor longus hallucis was then drawn through the interosseous membrane, and the point to which it would reach on the dorsum of the foot was determined. It was found to be amply long to reach to the point where the common extensor divides into its several tendons. A final incision was then made obliquely over this region, and the transplanted tendon was brought down subcutaneously to the desired point. It was here sutured, with chromic gut, to the "middle" and "ring" tendons of the extensor longus digitorum. All the incisions were then closed with chromic-gut sutures. The operation consumed nearly fifty minutes. The plaster cast was not removed until August 30, or nearly seven weeks after the operation. When the patient was told to flex his toes, the great toe and others were flexed, but the tendon of the transplanted flexor longus hallucis could be seen to contract on the dorsum of the foot. The notes say: "He walks with his ankle stiff, there being no apparent ankle-drop." As he had also paralysis of the quadriceps extensor femoris, with consequent inability to extend the knee, a brace was ordered to overcome this defect, and to support the foot until such time as further operative treatment should seem advisable. Since leaving the ward he has continued to have massage and electricity, as an out-patient, and the limb has gained considerably in strength. He can walk well without the brace, the sole of his foot coming fairly flat on the floor, whereas before the operation he could scarcely walk at all without the brace, and the outer surface of the foot and the external malleolus rested on the floor. There is still some tendency to varus, but the ankle-drop is very slight, and the power of voluntary extension of the knee has largely returned. Figs. 2 and 3, from photographs made in November last, show the location of the incisions and the extent to which the deformity has been corrected.¹

CASE III.—Eva S., aged four years, entered the service of Dr. Davis at the Orthopedic Hospital, November 18, 1902, when ten months old, with congenital equinovarus of the right foot. The foot could then readily be brought into good position. She was fitted with a brace, and wore this constantly. The foot, however, could

¹ Since the above was written Vignard (Lyon méd., 1907, cviii, 575, March 24) has reported transplanting the tendo Achillis through the interosseous membrane, to the dorsum of the foot, to overcome toe-drop.

not be made to stay in the correct position without the brace. On August 29, 1905, the foot was forcibly stretched (ether) so as thoroughly to over-correct the deformity, in the hope that this would enable the weak peroneal muscles to do their part in holding the foot straight. The patient wore the brace again constantly until



FIGS. 2 and 3.—Case II. Paralytic equinovarus, after operation.

October 27, 1906, when tendon transplantation was done, because, though the foot was perfectly flaccid and could easily be brought into the over-corrected position, the peronei seemed absolutely powerless to hold it straight. The tibialis anticus was strong, and constantly pulled the foot into a marked varus deformity, unless

restrained by the brace. The operation in this case was precisely the same as in Case I, except that silk sutures were employed. The time was twenty minutes. After some weeks the patient was sent home still wearing the cast. While at home she developed a very severe attack of conjunctivitis, for which she was admitted to another hospital. As a consequence it was not until January 8, 1907, or nearly eleven weeks after the operation, that she returned again to the Orthopedic Hospital. Removal of the cast on that date showed that the skin wound over the outer side of the foot had not entirely united, and that two silk sutures were protruding. These were removed, and a cast was again applied. January 15, this cast was removed and the skin wound was found to have united solidly. She was directed to wear an ordinary shoe and return in four weeks. On February 12, it was found that active motion pulled the foot into varus, suggesting that the tibialis anticus had slipped from the tuberosity of the fifth metatarsal bone, when the silk sutures separated by sloughing. On March 1, the patient was etherized, and the tibialis anticus separated from the dorsum of the foot, where it had become adherent between the first and second metatarsal bones, and again sutured to the tuberosity of the fifth metatarsal bone, with silk sutures. The result this time was excellent.

CASE IV.—Mary M., aged twenty years, entered the service of Dr. Davis at the Orthopedic Hospital, March 23, 1897, when twelve years of age. She had had an attack of poliomyelitis when about one year old. She was wearing a brace which had been ordered elsewhere. Without the brace her foot assumed a fairly marked varus deformity, owing to the paralysis which affected chiefly the peroneal muscles. The patient neglected treatment, returning once to the hospital in May 1898, but not again until November 20, 1906. It was now found that a moderate degree of varus persisted, owing to paralysis of the peronei, and that the tibialis anticus was also very weak. Dr. Boyer, who examined the foot electrically, reported that the tibialis anticus and peronei responded slightly to both galvanic and faradic currents, but not normally. No reactions of degeneration were present, however. The patient was very stout, and her foot was constantly turning under her; indeed, she stated that for some months she had been unable to walk a square without falling. Fig. 4 shows the degree of deformity present, as well as the contraction of the great toe due to the action of the extensor longus hallucis. On December 29, 1906, the patient was etherized, and the extensor longus hallucis was divided on the dorsum of the foot, its distal end being sutured to the neighboring tendons of the extensor longus digitorum, and its proximal end being transplanted to the tuberosity of the fifth metatarsal bone. It was sutured to the periosteum at this point by four chromic gut sutures. The patient had been operated on by tracheotomy when a child, and she took ether badly; the operation was also done without an Esmarch

bandage. For these reasons the time consumed was an hour. The cast was changed January 29, 1907, but was not finally removed until February 26, when the patient was directed to wear an ordinary shoe. Fig. 5 shows the foot in the position obtained by the operation and

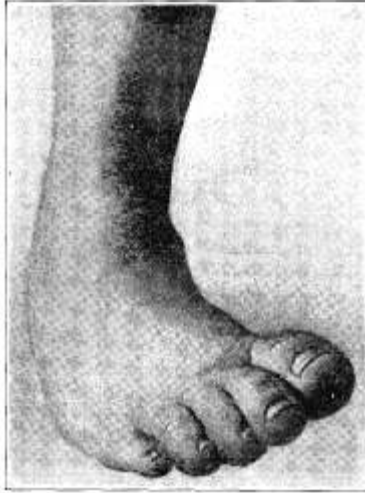


FIG. 4.—Case IV. Paralytic varus of the right foot, before operation.



FIG. 5.—Case IV. Paralytic varus of the right foot, after operation.

the absence of contraction of the great toe. Flexion of the ankle and eversion of the foot are well performed by the transplanted tendon.

CASE V.—Leslie E., aged fifteen years, entered Dr. Harte's service at the Orthopedic Hospital in November, 1906. At the age of seven years he suffered from an acute febrile attack, which left him with

partial paralysis of the right leg. Ever since, that is, for eight years, he has worn a brace. There is marked varus and cavus, with slight equinus. There is outward luxation of the head of the astragalus. There is atrophy of the calf, although some power of extension of the foot persists, but there is complete paralysis of the peronei.



FIG. 6.—Case V. Paralytic varus of the right foot, before operation.



FIG. 7.—Case V. Paralytic varus of the right foot, after operation.

Without the support of the brace, he stands on the dorsum of the foot (Fig. 6). On November 11, the patient was etherized, the plantar fascia was cut, the arch was depressed with the lever, the varus was partly corrected by the varus machine, and the tendo Achillis was finally divided. The foot then came into the over-

corrected position only with great tension. Put up in plaster. The cast was removed November 29, and after receiving massage for a week or ten days, the patient was again etherized on December 14, and the foot was again stretched, very forcibly, with the lever, and over the triangular block. The projecting astragalus was thus mashed into place, and the foot assumed quite a normal appearance. The cast was left on until January 2. On January 16, 1907, the patient was etherized for the third time, and the tendon of the tibialis anticus was transplanted to the tuberosity of the fifth metatarsal bone. Owing to the greater size of the foot it was not deemed advisable to attempt subcutaneous division of the annular ligament as in Cases I and III, so an incision was made over the tibialis anticus above the annular ligament, the tendon was here drawn up (after separating it from its insertion through the first incision), and was thence drawn through a subcutaneous channel to the desired point of suture over the tuberosity of the fifth metatarsal bone. The tendon was sutured to the periosteum in this place by four chromic gut sutures. The time consumed was thirty minutes. The plaster cast was left on until February 9, when it was changed. The patient was now allowed to walk about the ward with his cast for a shoe. The cast was finally removed on February 28, more than six weeks after the operation. The transplanted tendon contracted firmly in its new position, and produced good flexion at the ankle, with eversion of the foot (Fig. 7). With a shoe having the outer side of the sole raised a quarter of an inch it is difficult to detect in the gait any limp except that due to the general atrophy of the right lower extremity, which is an inch shorter than the left.

CASE VI.—Lizzie McQ., aged seven years, entered Dr. Davis's service at the Orthopedic Hospital, January 1, 1907. She had had an attack of poliomyelitis before she learned to walk. There was complete paralysis present of the tibialis anticus; and the peronei, the extensor longus digitorum, and the extensor longus hallucis all produced a fairly marked condition of valgus (Fig. 8). It was determined to transplant the peroneus brevis and the peroneus tertius into the tibialis anticus at its insertion. On January 25, 1907, an incision was made over the insertion of the peroneus brevis, and this was detached from the bone. An incision was then made above the external malleolus, behind the fibula, and the tendon of the peroneus brevis was drawn up. A third incision was made over the insertion of the tibialis anticus, and the tendon to be transplanted was drawn down subcutaneously to this point, where it was sutured with four silk sutures to the tibialis anticus (the foot being held in the calcaneovarus position), and with two other silk sutures to the periosteum of the scaphoid bone. Then an incision was made over the peroneus tertius, which was detached from its insertion and transferred subcutaneously across the dorsum of the foot to the inner side, where it was sutured to the tendon of the tibialis

anticus and to the periosteum with three silk sutures. The incisions in the skin were all closed with chromic catgut. The time of the operation was twenty minutes. A plaster cast was applied, and not removed until March 26, more than eight weeks after the operation. The transplanted tendons were found firmly united to

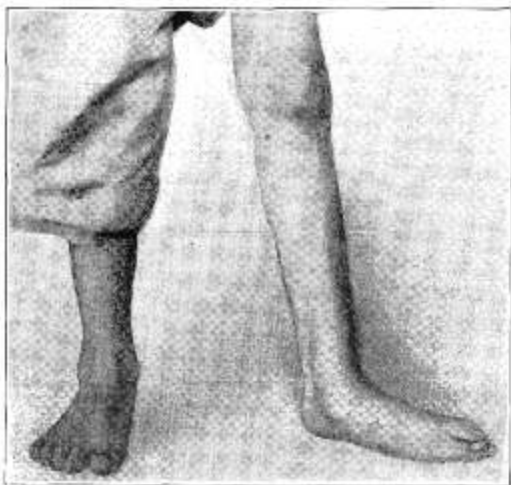


FIG. 8.—Case VI. Paralytic valgus of the left foot, before operation.

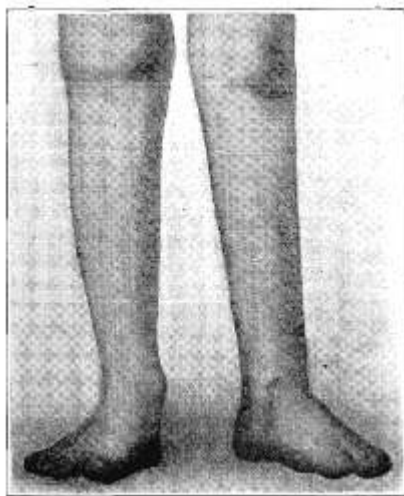


FIG. 9.—Case VI. Paralytic valgus of the left foot, after operation.

the tibialis anticus. By their contraction the arch of the foot is restored (Fig. 9), and the foot instead of being pulled by flexion into the extreme valgus position as was the case before the operation, is now flexed without appreciable deviation from the mid-line. The patient wears an ordinary shoe, and does not limp.